RESEARCH PROPOSAL

PALEOGEOMORPHIC FEATURES AND ASSOCIATED LANDUSE IN THE LOWER AJAY BASIN, WEST BENGAL

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INTRODUCTION:

A branch of geomorphology which studies the ancient landforms is called Paleogeomorphology. This branch of geomorphology may become increasingly important to understand the landscape evolution in past and present terrain character as well as future evolution of landscape. It is concerned with the recognition of ancient surfaces and the study of ancient topographies and topographic features that are now concealed beneath the surface and partially have been removed by present geomorphic processes of erosion. Various land forms like relict, buried and exhumed features are the most identified features in paleogeomorphic landform analysis. These land forms may be millions of years old or only a few thousands of years old, and are recognized as paleogeomorphic land features. In this sub branch of geomorphology, scientific investigation is made to study the morphology of buried erosional landscape and must be worked out in connection with subsurface studies of unconformity surface. Modern geomorphological concept is placed in determining the pattern of ancient landforms and past geomorphic processes. It also includes controlling factor of such geomorphological setup, like relative resistance of the strata, structure, paleogeomorphic process; which in past determine the particular types of drainage pattern or any other geomorphic processes are taken into account. Since the ancient geomorphological environment of the earth surface is preserved in stratigraphic records, this type of analysis is used for detailed study of sedimentary basins. Sometimes paleogeomorphic features of remote past are completely wiped out, therefore Pleistocene Landscape is properly considered as of paleogeomorphic nature, though in some cases it might be only a few thousand years old. These Landscape features have been modified by past glacial processes, but their distinctive character in some cases are preserved mainly because the processes are no longer operative on them. The earlier works on paleogeomorphology mainly deals with the geological analysis of erosion surface. Mckee (1963) and Martin (1966) shows the differential compaction of sediments above a buried landscape, but their explanation mainly deals with the buried landscape features for mineral exploration., Wright (1958) Condra (1963) has described examples of relict Late Tertiary and Pleistocene drainage lines in Sahara desert in Morocco, Algeria and Libya. Krumbin (1942) primarily investigate the paleogeomorphic features of marine origin .The mid-Eocene erosional buried channel in the Wilcox formation near Yoakum, Lavaca country, Texas has been described by Hoyt (1949) and Cotton (1948) they suggested that a buried erosion surface or paleochannel may retain its characteristics essentially intact after exhumation if the rocks upon which it was developed are strongly resistant in comparison with the cover mass beneath which it was buried. A number of sub discipline closely related to Paleogeomorphology are the Paleopedology, Paleobotany, Paleonotology, Paleoecology, Geology, Areacheology, etc .Sometimes paleogeomorphic explanation is based upon the information generated by these above mentioned disciplines, like information related to buried channel, are exerted from Paleopedological analysis, because ancient soil throw light upon history of paleogeomorphic features. Paleonotology, which is the interpretation of fossils and fossil assemblages from a biological point of view, throws much light on wider information in sedimentation, stratigraphy, and paleogeomorphology.

OBJECTIVES:

The work is under taken to study the paleogeomorphic pattern of lower Ajay basin with the primary objectives of

1. Identifying the paleogeomorphic features and their relative dating
2. Analyzing the evolutionary phase and sequential changes in the geomorphic history of the Basin area.
3. Studying the influence of paleogeomorphic features on the land use pattern in the study area.
4. Exploring how the river system and landscape of the basin have been affected by quaternary climate change and monsoonal fluctuation, and sea level change?
5. Making an assessment to correlate the present topographical setting with past geomorphological character.
6. Exploring the changing drainage pattern or change of river course through paleochannel identification and their interconnection with early human society.
7. Examining the modification of paleogeomorphic features from upper paleolithic period to present by human.
8. Formulating suitable measures for management of paleogeomorphic settings in the study area which would improve the present hydro geomorphological character in the basin area.

HYPOTHESES:

In the light of the above objectives, the following hypotheses have been considered

1. The course of the river Ajay has changed several times in geological past.
2. There are imprints of climate change during Pleistocene and Holocene periods in past topographic features.
3. Buried paleotopographic features have been preserved as discontinuities in the interfluves stratigraphy.
4. The paleogeomorphic features have largely determined the land use character of the basin.
5. Changing course of drainage network resulted into the decline of early human settlement

PREVIOUS WORK:

Understanding the causes involved in brining changes in the course in a river; requires an appreciation of fluvial processes that operate over time and space in a river basin. Moreover to study them, the geomorphic, geologic, tectonic and climatic and cultural as well histories of a drainage basin have to be taken into consideration. In fact complex processes and factors are involved in the functioning of the geomorphic and hydrologic phenomena. Both the phenomena have been influencing man from time immemorial as such attract the scientist to study their nature, characteristics, magnitude, intensity, frequency, extent *etc.* not only to understand them but also find out solutions and mitigate their hazardous affects on man.

The deciphering and remodeling of the changes in the river course are results of skillful and thorough understanding of the various processes involved. Analysis of the geomorphic evidences, remotely sensed data and terrestrial photographs are done to trace changes in the courses over time and space. The constant process of alluviation buries almost all the previous evidences (except the latest ones) of geomorphologic events on the surface making the tasks of identifying earlier fluvial works more difficult. However with the availability of high resolution remote sensing data, GIS programmes and various tools of surface and subsurface surveys (like echo- sounding and radar) research on present and prior courses of rivers has become more scientific and interesting. However such attempts on the Ajay River and its tributaries are very few.

Development on the space science has made it possible to collect the images of the earth surface from the satellite and airborne platforms in different bands at various scales providing a new horizon for analysis of geomorphic, geologic, and hydrologic evidences. The underlying layers of the earth's surface always have impact on surfacial development and leave its imprints on it in most of the cases. It becomes imperative if study of changing course of rivers is conducted in relation with discharge and sediments of the concerned river. This is because both are interrelated and influence each other as a part of integrated fluvial process in a river basin. Truly, in this way the river basin acts as a system whose various parts and functions are interrelated and interdependent and interconnected to carry out the ultimate processes of erosion, transportation and deposition in the course of sculpturing the landforms. That also leads to creation of dynamic equilibrium between the processes and forms in a river basin. Interpretation revealing relations between the changing course and discharge and sediment load also become useful largely for river training works for long term river basin planning and to explore water resources, thereby to save life and property as far as possible. Different approaches were adopted in isolation to develop hydraulic models depicting the river behaviour and dynamics. Therefore relevant literature have been reviewed, first to get theoretical insight into the problem and secondly to note the relevant empirical work on the topic of the research. Migration of the course of a river and floods in its valley belong to the river dynamics. Shifting of a river course means that at a particular point of time and space a river abandons its original course and starts flowing along another course (Thornbury, 1954). However, the major controls governing the behaviour of the river system in shorter and longer time scale are geomorphic, geologic, climatic and biotic. The interpretation of the past changes in river course depends on ability to explain and understand the present. This is simply an outcome of basic geomorphic knowledge *present is the key of the past that* is based on the *principles of uniformitarianism* propounded by Hutton (1785). Thornbury (1954) has rightly worked this principle as *"The physical processes and laws that operate today operated throughout geologic time, although not necessarily always with the same intensity as now"* .Though the interpretation of changes in river course is highly dependent on the experiences and knowledge of the interpreter, the development of modern technologies has led to availability of more precise and reliable data and thus made the effort of the interpreter easier. Several studies have been conducted on Paleogeomorphology in different parts of the world.Condra (1963) investigated the paleodrainage of Sahara desert region and explored the pre-Nile drainage characteristics of North Africa. Paleoclimate

and related geomorphic processes have been studied by Hyot (1959). Krumbein (1942) investigated the buried paleotopographic characteristics and evolutionary phase through the subsurface unconformities. In India especially the geological schools in different universities have analysed the paleogeomorphic characteristics in different geoclimatic region. The emphasis is given in the sea level fluctuation, marine recession and transgression, paleohydrodynamics, and alluvial topographic evolution. Banerjee *et.al.* (1987) studied the Holocene sea level and coast line changes in Bengal basin. Gupta, (1988) traced possible impacts of post Pleistocene environment on the cultural sucession of Indo- Gangetic plain. Nyogi, (1975) explores the quaternary landforms in the coastal Orissa and West Bengal. Prudhvi Raju *et, al.* (1981), Samba Siva Rao, (1982), Roy (2005), K.Subrahmanyam *et, al.* (2007), studied geomorphic evolution and paleotopographic features in different parts of India. Lalan *et. al.* (1998) investigated the Paleopedological characteristics of Indo-Gangetic plain.

Though, some researchers have conducted studies on different hydrogeological and fluvio geomorphological aspects of the Ajay River, but the complete spectrum of changes in course of Ajay River has neither been revealed yet nor its influence on alluviation of the valley and formation of landforms has been studied. It has been observed during the last decade that the river course is undergoing rapid modifications. Therefore there is a need of regular and updated studies.

METHODOLOGY:

Analysis of Paleogeomorphology is too complex because it depends on various parameters of paleogeographical environments which vary with space and time. The research methodology can be divided into three phases

PRE- FIELD METHOD:

1. In order to acquire a comprehensive knowledge of the paleogeomorphology of lower Ajay basin, a thorough study is required to be made from the relevant works done by the different authors and agencies – government and non-government organizations.
2. Study of the basin information is supplied by geological survey of India published report, published report of central ground water investigation board. During this phase consultation of Survey of India Topographical sheets, satellite imageries is done for identifying paleogeomorphie features in study area.

FIELD METHOD:

1. Investigation of the terrain characteristics of paleogeomorphic features by different instruments.
2. Collection of sample geomaterials from various paleogeomorphic features.
3. Comparing the past and present drainage course, paleofeatures within the basin area and their related land use/ land cover categories.
4. Collecting the information of paleosoils from soil profiles.

POST- FIELD METHOD:

1. Assessing the present condition of paleogeomorphic features by systematic arrangement of various facts.
2. Measurement of the paleogeomorphic features, paleohydrology, paleopedological character by different statistical methods.
3. Preparation of map showing the pattern of paleogeomorphology of lower Ajay basin.
4. Laboratory analysis of geomaterials on the basis of their dating reports.
5. Interpretation of analyzed data, assessment of the present condition and giving suggestion for understanding the changing hydro geomorphology of the basin area from remote past to present.
6. Writing up thesis report in the form of dissertation.

DATA BASE:

Primary data

Following types of primary data were collected and used for the present study-

1. The changes in the river course of Ajay River were identified and mapped through multi-date remote sensing data and Toposheets and then verified through field investigation by collecting geomorphologic and hydrological evidences.
2. Paleogeomorphic mapping of the study area has been done through the field work and with the help of SOI Toposheets and Satellite Imagery.
3. Terrestrial photographs have been used to analyze and support the findings related with the research problem.
4. Oral tradition and written records were also used for extracting information on the courses of the Ajay River during the recent past.

Secondary Data

Secondary data used in the present study are as follows -

1. Topographical information relevant to study was extracted from the SOI Toposheets and updated using multi- date satellite imagery.
2. Precision Geocoded False Colour Composites (FCCs) of IRS- P6 & LISS-III, covering the study area for the year 2006 were used for visual interpretation to identify changes in the courses of the Ajay River and demarcate the paleogeomorphic units in the study area.
3. The historical gauge and discharge data from 1977-2010 were collected from Irrigation and Disaster Management Department.
4. Published and unpublished Geological, hydrological, pedological and stratigraphic maps and diagrams have been used in the present study.

STUDY AREA:

Lower Ajay basin is considered as one of the most important geographical unit with respect to paleogeomorphological set up. Lower Ajay basin extends between *23°25′00″ N* to *23°50′00″ N* Latitudes, and *87°10′00″ E* Longitude to *88°12′00″ E* Longitude with an area of 3034 Km² which is 48.4% of the total geographical area of the basin. The Ajay River emerges from the forest covered hill of Chakai block in Munger district of Bihar state and drains parts of Chhotnagpur plateau, Andal Raniganj coalfields and the Gangetic flood plain and ultimately joins the Bhagirathi (a tributary of Ganga) at Katwa. Lower Ajay basin lies partly in five blocks of Birbhum District namely – Khoyrasole, Dubrajpur, Illambazar, Bolpur, Nanoor and ten Blocks of Burdwan District namely Jamuriya, Pandbeswar, Foridpur Durgapur, Kanksa, Ausgram-I, Ausgram-II, Mongolkote, Ketugram -I, Ketugram –II and Kattwa –I. Geologically consolidated formation of Archean gneiss, semi consolidated formation of Gondwana and consolidated formation of Vindhyan old and young alluvium is predominant. Relief of the Lower Ajay basin ranges from 100 *mts* to 12 *mts*. Average slope is 6*mts/km*. climatically the study region is experienced by seasonality of rainfall and temperature, average annual rainfall is 1303.7 *mm*. mean summer maximum temperature around 38°c and mean winter temperature around 10°c. Pedologically laterite and old and young alluvium is main soil group.

Tentative Chapters:

CHAPTER: 1. *INTRODUCTION*

CHAPTER: 2. *GEOLOGY AND TECTONIC BACKGROUND*

CHAPTER: 3. *CLIMATE AND PEDOHYDRLOGIC SETUP*

CHAPTER: 4. *RELIEF AND DRAINAGE ANALYSIS*

CHAPTER: 5. *IDENTIFICATION OF PALEOGEOMORPHIC FEATURES AND THEIR CHARACTERISTICS*

CHAPTER: 6. *GENETIC ASPECT OF PALEOGEOMORPHIC FEATURES*

CHAPTER: 7. *PALEOGEOMORPHIC CORELATION*

CHAPTER: 8. *PALEOGEOMORPHIC FEATURES AND ASSOCIATED LAND USE AND LAND COVER*

SUMMARY AND CONCLUSION

REFERENSES AND BIBLIOGRAPHY

PRACTICAL UTILITY OF THE PROPOSED RESEARCH WORK:

The proposed study is based on the intensive field work which gives an overview of the complexities of the geomorphic form and stratigraphic development over vast tract of Ajay-Bhagirathi river system. These types of studies in different spatial domains have an important bearing on the understandings of the accumulation and filling of basin system in areas dominated by Monsoonal regimes and Cenozoic tectonics. For micro level investigation of change in river course and their effects on hydrogeomorphological dynamics in the alluvial plains such types of study get a great importance. However these types of studies have become increasingly relevant in preparation of frame work of cultural evolution and correlation charts of lithological horizons and early civilization, Quaternary climate change and landscape evolution. On the basis of the present study, a model is formulated to understand the complex balance of water and sediment discharge through time in rivers of the plain areas.

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